

NATIONAL SUMMARY: AGENCY RESPONSES

(Identifying environmental pressures and gathering the comprehensive data for the National Assessments (the discussions in the previous sections) were mandated by the USCRTF National Action Plan. USCRTF agencies and their partners have worked together to make the National Action Plan a reality (USCRTF 2000). In less than two years, significant progress has been made on the two fundamental themes and action items (USCRTF 2002). The two themes and action items identified by the USCRTF are discussed in the remainder of this section.

Theme 1: Understand Coral Reef Ecosystems –

Understanding coral reef systems is necessary to 1) discern the conservation measures needed and 2) evaluate potential impacts of actions on the condition of the coral reef ecosystems. This includes comprehensive mapping, assessment, and monitoring of coral reef health (Fig. 102); supporting strategic research on regional threats to coral reef health and the underlying ecological processes upon which they depend; and incorporating the human dimension into conservation and management strategies.

Theme 2: Quickly Reduce the Adverse Impacts of Human Activities – Reducing impacts requires an expanded and strengthened network of Federal, State, and territorial coral reef MPAs. Along with this, it is necessary to reduce the adverse impacts of extractive uses, habitat destruction and pollution; restore damaged reefs; strengthen international activities, ameliorate the impacts of international trade in coral reef species; improve governmental accountability and coordination; and create an informed and engaged public. Many of these actions require effective monitoring of reef health, tracking biotic changes, and evaluating impacts of conservation measures on affected components of the managed ecosystems.

In FY00 and FY01, DoI and NOAA provided over \$2 million in grants to help the U.S. islands¹¹⁵ improve coral

reef management and conservation. This included monitoring, education, and designation of marine protected areas. Additionally, in FY00 NOAA provided \$7.8 million, and in FY01 \$27 million to agencies with coral reef management responsibilities for other initiatives for conserving coral reef ecosystems. In FY02, a total of \$34 million will be available from NOAA to continue coral reef initiatives on U.S. coral reef ecosystems and to initiate related efforts for reefs off the Pacific Freely Associated States.

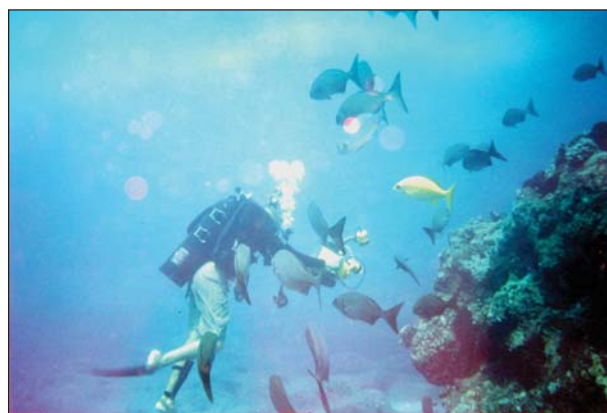


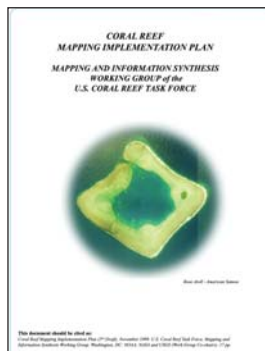
Figure 102. Assessment of a coral reef in the Northwestern Hawaiian Islands (Photo: Donna Turgeon).

The information used to prepare the biennial reports mandated by the Coral Reef Conservation Act of 2000 has to be based on reliable monitoring data and ecological assessments. NOAA and DoI are helping local agencies build their scientific capacity to assure that information will be available for those reports.

Map All U.S. Coral Reefs

As discussed before, most U.S. coral reefs have never been adequately mapped. The agencies of the USCRTF are undertaking a major effort to develop comprehensive and consistent coral reef ecosystem maps for all U.S. reefs (Fig. 103). This is led by NOAA, the National Aeronautics and Space Administration, and the USGS (MISWG 1999).

Figure 103. Cover of the Coral Reef Mapping Implementation Plan.



¹¹⁵ Puerto Rico, the USVI, Hawai'i, American Samoa, Guam, and the CNMI.

The USCRTF National Action Plan committed to delineating and digitally mapping all U.S. shallow coral reefs by 2009 using airborne and satellite photography. Mapping and habitat characterization of selected deep reef and bank areas has also begun using multi-beam sonar, submersibles, and remotely-operated vehicles. This information will support more effective fish and coastal zone management, disaster mitigation, research, and restoration efforts.

Detailed and spatially accurate digital benthic habitat maps can be used to design monitoring programs, organize data, and conduct assessments. Digital data and the associated maps delineate major habitat types – seagrass, coral reefs, and mangroves – and can provide a framework for tracking changes in those habitats (Monaco *et al.* 2001). Other measurements of the ecosystem that correlate with habitat change¹¹⁶ can be layered onto these maps and perhaps ultimately used to help predict habitat change. Completed maps and related information (discussed in the following subsections) are available on a NOAA web site (Coral Reef Mapping and Monitoring 2002).

Caribbean Shallow-Water Mapping Initiatives –

The characterization of marine habitats of Puerto Rico and USVI has been completed, and benthic habitat maps are now available (Coral Reef Mapping and Monitoring 2002). This was a collaborative project¹¹⁷ using visual interpretation of aerial photographs (Fig. 104). NOAA's National Geodetic Survey acquired aerial photographs for the near-shore waters in 1999.

Working in conjunction with the State of Florida, similar maps are available as a benthic habitat atlas of the Florida Keys (FKNMS Benthic Map 2002). Since this is just for the Keys, about 50% of Florida's coral reef ecosystem still needs to be mapped.

Pacific Shallow-Water Mapping Initiatives –

NOAA is leading an investigation to map the distribution of coral reefs and other benthic habitats throughout the U.S. Pacific islands. Remote-sensing technologies, ranging from ships to satellites will be used to create digital maps of marine habitats including coral reefs, seagrass beds, and mangrove forests.

Gulf of Mexico Deep-Water Mapping

Initiatives – In 2001, USGS, MMS, and NOAA completed multi-beam sonar mapping of major



Figure 104. An aerial photograph of St. John, that was used to produce benthic habitat maps (Photo National Ocean Service).

areas off the Northeastern Gulf of Mexico including the newly-designated Madison-Swanson and Steamboat Lumps Marine Protected Areas. These are important habitats for commercial reef fishes and contain some deep reefs that may rival those in the FGBNMS.

In 2001, NOAA also conducted habitat characterization of deep *Oculina* coral reefs off the eastern coast of Florida using submersibles and multi-beam sonar. Results showed significant habitat damage to protected banks from illegal trawling.

Assess and Monitor Reef Health

The USCRTF's National Action Plan (2000) called for an integrated nationwide coral reef monitoring system that could provide regular assessments of reef health as well as initiate new monitoring to fill gaps. This will provide the essential information managers need to respond to changing environmental conditions, to assess the effectiveness of management strategies, and identify the need for additional protective measures. Since then, NOAA initiated and is leading a coordinated effort to determine the condition of coral reefs, the causes of coral reef decline, and the impacts of environmental pressures on coral reef ecosystems.

A National Program to Assess and Monitor Coral Reef Ecosystems –

In FY99, 50 coral reef managers and scientists prepared an Implementation Plan for *A National Program to Assess and Monitor Coral Reef Ecosystems* (National Coral Reef Program, Coral Reef Mapping and Monitoring 2002, Fig. 105). In FY00, NOAA held a

¹¹⁶ Fish abundance, coral diversity, disease, and oceanic circulation patterns.

¹¹⁷ There are local partners and collaborators, including island agencies and universities, the NPS, and USGS.

workshop for 60 coral reef managers to rank environmental threats and prioritize management needs (e.g., biotic inventories, ecosystem monitoring, and assessments of the sources and extent of reef degradation). The managers endorsed the proposed program (the National Coral Reef Program).

Now in its third year of NOAA funding, the National Coral Reef Program has provided cooperative grants to state and island agencies to build local capacity for assessing and monitoring coral reef ecosystems. With this funding, coordinated monitoring is being conducted off Puerto Rico, the USVI, Hawai'i, American Samoa, Guam, and the CNMI. Another major objective of this program,



Figure 106. Video monitoring in La Parguera, Puerto Rico (Photo: John Christensen).

coral reef ecosystem health indicators, metrics, and a 'report card' will be developed to evaluate changes in the condition of benthic habitat, living marine resources, and water quality. NOAA's National Ocean Service will integrate local assessments into these biennial reports. They will evaluate the effectiveness of activities to conserve reef resources.

Also a part of the NOAA National Mapping and Monitoring Network, complementary monitoring is being conducted off Puerto Rico, Florida, and Hawai'i. NOAA sponsored additional work through cooperative grants from pass-through appropriations in FY00-02 to the Department of Natural and Environmental Resources of Puerto Rico, the National Coral Reef Initiative (NOVA University Florida), and the Hawai'i Coral Reef

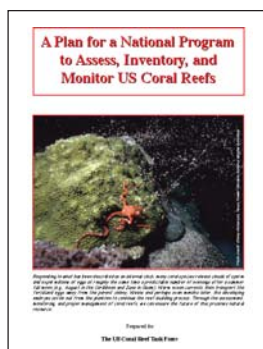


Figure 105. Cover of the National Program to Assess and Monitor Coral Reef Ecosystems.

Initiative (the University of Hawai'i).

With the USEPA and NOAA, the FKNMS Water Quality Protection Program monitoring continues in the Florida Keys. Specific monitoring of ecosystem process and functional changes that result from the implementation of fully protected marine reserves is also underway.

Regional Assessment and Monitoring Activities

Most of the U.S. coral reef ecosystem monitoring is conducted by State, Commonwealth, and Territory

agencies, at times in conjunction with Federal agencies or with local non-governmental organizations. The following is a summary of FY00-01 activities in each jurisdiction.

Florida - In the Florida Keys, fish and benthic habitat assessments and monitoring were conducted and an integrated molecular biomarker system was used to assess ecosystem health. Four cruises performed baseline surveys of the Tortugas Ecological Reserve to determine the influence of Reserve status on fish communities, the food web, and habitat structure and function (FKNMS 2002).

Puerto Rico - Puerto Rico established a Commonwealth-wide network of monitoring sites where sessile-benthic organisms, reef fish, motile invertebrates, and water quality were surveyed (Fig. 106). They also conducted a baseline characterization of bio-optical properties, surveyed three coral reef locations to gain baseline information, and assessed the effects of establishing a no-take zone at the Luis Peña Natural Reserve on Culebra Island. Additionally, a baseline characterization of the fish and motile and sessile benthic invertebrates inhabiting coral reef and sea grass habitats was conducted at 15 sites on Vieques Island.

U.S. Virgin Islands - The USVI Department for Planning and Natural Resources has partnered with the University of the Virgin Islands, the National Park Service (NPS), and the USGS to start filling gaps in monitoring and establishing a Territory-wide Monitoring Network. (USGS 2002, Coral Reef Mapping and Monitoring 2002).

Hawai'i - In the NWHI, monitoring and assessment techniques were developed as part of an overall effort to inventory the shallow-water reef biota and map benthic habitats around each of the 10 remote



Figure 107. Diver assessing the condition of reefs surrounding Howland Island (Photo: James Maragos, USFWS).

islands and atolls (Hawaii DLNR 2002). Initial survey data assessed the impact of bottom fishing on the Raita and West St. Rogation Banks in the NWHI Coral Reef Ecosystem Reserve. State-wide monitoring of coral reef habitats, algae, invertebrates, fish, marine mammals, and sea turtles of the Main Hawaiian Islands continued (CRAMP 2002).

American Samoa – American Samoa hired two fisheries biologists in the Department of Marine and Wildlife Resources. They are conducting fish census surveys of commercial fish stocks and a creel survey of market species. Water quality monitoring is currently limited to 12 beaches on Tutuila and the Manu'a group, but is being enhanced with new instrumentation.

Guam – A monitoring program for the recently created MPAs has been initiated (University of Guam MPA Research Group 2002). These activities complement ongoing inshore and off-shore island-wide creel surveys, weekly water quality tests, freshwater hydrology and contaminant testing and the University of Guam's benthic transect surveys. They monitor for disease and coral bleaching (Guam DAWR 2002).

Commonwealth of the Northern Mariana Islands – CNMI hired a marine biologist to coordinate its coral reef monitoring program (CNMI DEQ 2002). Biweekly monitoring surveys are conducted on Saipan, Tinian, Rota, and Aguijan. The USFWS conducted its annual coral reef monitoring of Farallon de Medinilla reefs and provided monitoring assistance to the U.S. Navy by monitoring for impacts of military training activities.

Pacific Remote National Wildlife Refuges – The USFWS continued surveying and

monitoring coral reef ecosystems in its Pacific Remote Islands National Wildlife Refuges of Howland, Baker, Jarvis, Palmyra Atoll, and Kingman Reef (Fig. 107). The USFWS participates in the Northwestern Hawaiian Islands Reef Assessment and Monitoring Program with follow-up surveys and continues to conduct surveys at Midway Atoll National Wildlife Refuge.

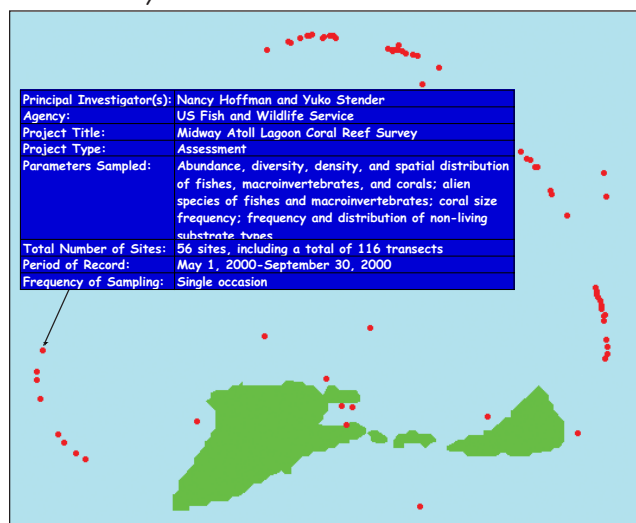
As of early 2002, the USFWS established 38 permanent coral reef monitoring transects, most with the cooperation of NMFS, at Baker, Howland, Jarvis, Johnston, Kingman, Palmyra, Rose, and Swains in the remote U.S. Pacific Islands and Midway, Pearl and Hermes, Maro, and French Frigate Shoals in the NWHI.

Pacific Freely Associated States – The USFWS has completed reports on its biennial inventory of significant marine species at U.S. Army Kwajalein Atoll in the Republic of the Marshall Islands.

National Survey of Monitoring Capacity – To determine gaps in ongoing coral reef monitoring programs, NOAA launched its Survey of U.S. Coral Reef Monitoring Projects in FY99. This comprehensive survey inventoried a total of 439 ongoing programs and projects assessing and monitoring coral reef ecosystems. The information gathered by this survey is now available in a GIS and metadata database (Coral Reef Mapping and Monitoring 2002, Fig. 108).

Survey results indicate that significant geographical disparities exist in the quantity and quality of monitoring projects conducted around the United States and its associated territories (Asch and

Figure 108. GIS-image pinpointing coral reef monitoring sites around Midway Atoll.



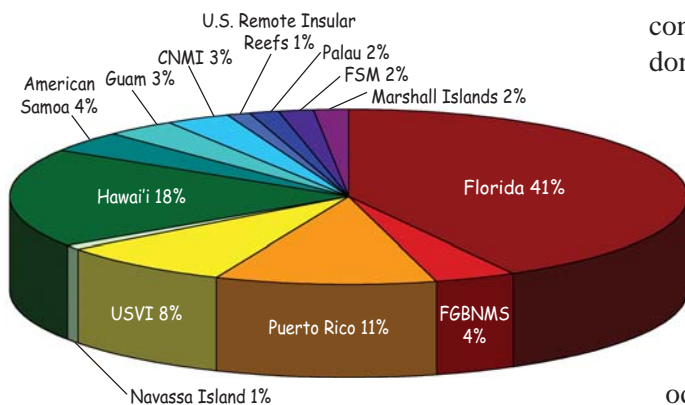


Figure 109. Percentage of 439 monitoring and assessment projects inventoried in 2000 in each region of the United States and Freely Associated States.

Turgeon in press, Fig. 109). A series of environmental problems occurred in the early 1990s involving the Florida Bay aquatic ecosystem and plans for 're-plumbing' the Everglades. Therefore historically, most of the U.S. coral reef monitoring support had focused on the Florida Keys. Since 2000, U.S. agency efforts have focused on building island capacity for long-term monitoring and other coral reef conservation activities.

The National Coral Reef Monitoring Network – NOAA has made considerable progress in the development of a web-based data management and information system for the nation-wide integration of monitoring and mapping data. A large team of coral reef scientists and information technology specialists was brought together and is developing a NOAA single-point-of-discovery information management system for coral reef data and information (CORIS). CORIS provides direct access to coral reef data and information, including relevant NOAA Library holdings (CORIS 2002).

Coral Reef Watch Program – To predict bleaching events, NOAA's Coral Reef Watch Program combines real-time environmental monitoring data from satellites and the in-water Coral Reef Early Warning System (CREWS) sensors (Fig. 110). Near real-time bleaching alert systems are now available on the web (NESDIS 2002). New CREWS systems

Figure 110. A CREWS in-situ sensor in the Bahamas (Photo: Coral Reef Watch Program).



continue to be installed worldwide with 20 domestic systems expected to be in place by 2007.

Volunteer Monitoring Programs – A variety of volunteer monitoring programs collect information on coral reef ecosystems. These provide data and related information to the National Coral Reef Monitoring Network and enhance the monitoring being conducted by agency and non-governmental scientists.

These programs differ widely in scope, methods, and parameters measured, and may have issues regarding the quality of data. However, all provide the opportunity to educate the public, engage them in coral reef monitoring, and get basic information with minimal expense.

Global Coral Reef Monitoring Network (GCRMN) – This global network consists of 15 independent networks (nodes) in six regions around the world (GCRMN 2002). It focuses on regional databases used in national reports on reef status. The National Coral Assessment and Monitoring Program supports regional GCRMN activities and contributes regional reports to GCRMN for its biennial report on the *Status of Coral Reefs of the World*.

Reef Check – Initiated in 1997, Reef Check is a protocol for rapid assessment of reefs specifically designed for non-professionals and volunteers (Reef Check 2002). It evaluates the effects of human impacts on coral reefs. Annually it engages a large cadre of volunteer SCUBA and free divers in over 50 countries to survey selected harvested species, classify benthic substrates using the point-

intercept method, and report coral reef damage from bleaching and other stresses. The GCRMN designated Reef Check as its community-based monitoring protocol (Westmacott *et al.* 2000).

Reef Environmental Education Foundation (REEF) – Since 1990, this nonprofit organization has educated the public about marine resources and engaged divers and snorkelers in long-term monitoring (REEF 2002). REEF surveys fish distributions in the tropical western Atlantic, along the U.S. and Canadian West Coast, in the tropical eastern Pacific¹¹⁸, and off Hawai'i

¹¹⁸ From the Gulf of California to the Galapagos.



Figure 111. A REEF volunteer monitoring a site in the FKNMS (Photo: Heather Dine).

(Fig. 111). With NOAA, REEF evaluates the effectiveness of management zones in protecting fish resources in the FKNMS (Jeffries *et al.* 2000).

Atlantic and Gulf Rapid Reef Assessment (AGRRA) Program – Since June 1998, over 22 large-scale rapid ecological assessments on the condition of reef-building corals, algae, and fishes have been completed (AGRRA 2002). In 2001, a joint AGRRA and REEF project surveyed the FGBNMS; the data collected were used as part of the evidence that these reefs are in excellent condition.

Caribbean Coastal Marine Productivity (CARICOMP) Program – This program was initiated in 1985 to better understand regional phenomena¹¹⁹ that potentially control Caribbean coastal ecosystems (CARICOMP 2002). It is a regional network of greater Caribbean marine laboratories, parks, and reserves, with over 25 sites in 18 countries. It is dedicated to discriminating between human disturbance and natural variation within the reefs and reef-related habitats.

In 1991, CARICOMP instituted a synoptic, standardized monitoring program of coastal ecosystems that has centralized data management and communications. Members hold regular regional training workshops and facilitate directed research programs that involve members of the network and out-side investigators.

Reef Ecosystem Condition (RECON) – Initiated in 2000 by the Ocean Conservancy and the USEPA, RECON trains recreational divers to collect

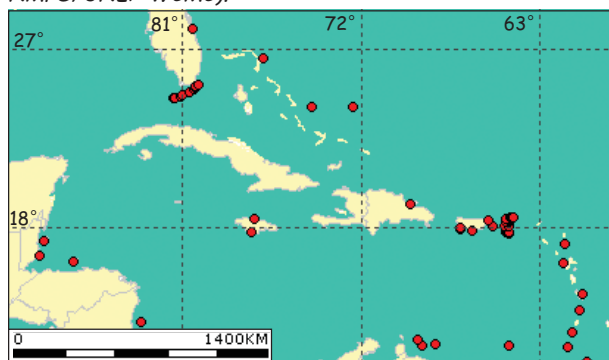
information on key environmental parameters, assess the condition of stony corals and seafans, and record the presence of certain key organisms and obvious human-induced impacts (RECON 2002). The program is currently being tested in the Florida Keys, Puerto Rico, USVI, and the Bahamas.

Conduct Strategic Research

The USCRTF National Action Plan called for additional research to better understand coral reef ecosystems and help determine what can be done to protect and restore them. In FY00-01, the USCRTF agencies sponsored research on disease, bleaching, coral growth, and other aspects. This increased understanding of coral reef health, degradation, and recovery. National and international research accomplishments include the following.

- The United Nations Environment Program's World Conservation Monitoring Center developed a web site for the global database of coral diseases (UNEP 2002, Fig. 112).
- The National Science Foundation (NSF) continued to support research and education projects related to reef structure and function. During 2000, NSF renewed a 40-year ecological research project on the coral reefs of the Great Barrier Reef and supported reef studies in Costa Rica, Panama, and the Galapagos. In 2001, NSF sponsored \$8 million of new coral reef projects and continued 25 other studies.

Figure 112. Map of the distribution of incidents of white-band disease in the Caribbean from the World Conservation Monitoring Center's global database of coral diseases (Photo: NMFS/UNEP-WCMC).



¹¹⁹ The 1983-84 mass mortality of the long-spined sea urchin, coastal eutrophication, and coral bleaching.

¹²⁰ At the University of North Carolina at Wilmington, the Caribbean Marine Research Center on Lee Stocking Island in the Bahamas, and the University of Hawaii at Manoa.

- The USFWS and the USEPA jointly funded a report titled *Mitigation of Coral Reef Impacts in the Pacific Islands*. This 2002 report evaluates the effectiveness of past compensatory mitigation efforts for federally-permitted or funded projects that removed coral reefs, and makes recommendations on ways to improve mitigation.

National Sea Grant Program – NOAA's National Sea Grant College Program has funded research on coral reef species and habitats for over 30 years. Over \$2 million a year in grants have gone for State Sea Grant Programs in Hawai'i, Puerto Rico, and Florida, as well as individual projects in other states.



Figure 113. Coralline algae growing on finger coral at a site in Hawaii studied by HCRI's Fish, Algae, and Coral Ecology Team (Photo: Jennifer Smith).

These projects have resulted in over 1,000 scientific publications in peer-reviewed journals and other technical reports in the Sea Grant Depository at the University of Rhode Island (Sea Grant 2002).

National Undersea Research Program – Three of NOAA's National Undersea Research Centers¹²⁰ (NURC 2002) spent over \$4 million on coral reef ecosystem research projects in FY01. NURC supported coral reef ecosystem research in the FKNMS, FGBNMS, Jamaica, the Bahamas, and off the Main and Northwestern Hawaiian Islands.

Hawai'i Coral Reef Initiative Research Program (HCRI-RP) – This is a collaborative research and monitoring effort¹²¹ to better manage



Figure 114. Researchers repairing a diseased coral colony (Photo: Richard Curry).

coral reef ecosystems in Hawai'i. Administered by NOAA, the HCRI-RP at the University of Hawai'i was established in 1998 by Congressional mandate and continues to receive Congressional funding. HCRI awards grants for projects that 1) address key threats to coral reefs and 2) reverse reef degradation (HCRI 2002, Fig. 113).

National Coral Reef Institute (NCRI) – A collaboration of universities and local/federal agencies¹²², NCRI's primary objective is the protection and preservation of coral reefs through applied and basic research on coral reef diversity, assessment, monitoring, and restoration (NCRI 2002). Established by Congressional mandate in 1998, it is administered by NOAA. NCRI continues to receive Congressional funding for its research projects. It provides scientific synthesis and evaluation criteria of existing programs for researchers and managers.

Coral Disease and Health Consortium (CDHC) – With the USEPA and DoI, NOAA implemented the CDHC in 2000 to study the effects of natural and human stresses on coral communities (Fig. 114). CDHC research projects focus on the synergistic effects of disease and environmental stresses, and how these factors impact coral reefs.

Activities include coordinating disease research, tracking disease and predicting outbreaks of coral disease and bleaching, characterizing disease agents and transmission dynamics, and evaluating indicators of health status.

¹²¹ Main collaborators are the University of Hawai'i, Hawai'i Division of Aquatic Resources, and the Pacific Science Association/Bishop Museum.

¹²² Collaborators include Nova Southeastern University, U.S. Navy's Office of Naval Research, NOAA, City of Miami Beach, Broward County Department of Planning and Environmental Protection, National Fish and Wildlife Foundation, and Nautronix, Western Australia.



Figure 115. In the Southwest Islands of Palau, the traditional island lifestyle emphasizes subsistence fishing (Photo: NOAA).

National Center for Caribbean Coral Reef Research (NCORE)

– Established by the USEPA as a Federal Demonstration Project in 1999, NCORE still receives supplemental funding from NOAA, NSF, and other public and private sources. Located at the Rosenstiel School of Marine and Atmospheric Sciences of the University of Miami, NCORE integrates and refines physical and biological models to predict the consequences of either a given disturbance or a change in management strategy on the ecology of a coral reef and on reef-dependent people (NCORE 2002).

Understand Social and Economic Factors - The Human Dimension

Coral reef management has traditionally focused on the biophysical aspects of coral reefs. Since reefs are coming under increasing pressure from human activities, better understanding the human dimension must play an important role in management programs. To ensure long-term success, programs must also involve the local community and create cooperative management.

Human activities and their resulting impacts are woven into the social, cultural, and economic fabric of regional coastal communities. This is particularly important among many of the U.S. Islands, where traditional management of coral reef resources, including subsistence fishing, have been an integral part of local government (Fig. 115).

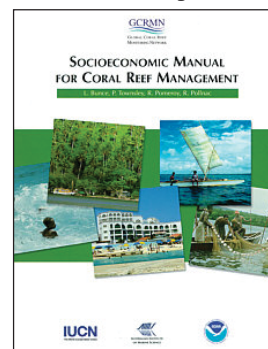
The human dimension has become a significant component of USCRTF coral reef conservation activities. In FY00, NOAA shifted its priorities toward a more interdisciplinary approach, and began to diversify its focus, sponsor human

dimension data collection, and help build capacity for long-term coral reef conservation by State, Territorial, and Pacific Freely Associated State agencies.

Socioeconomic Activities – USCRTF agencies initiated a variety of projects in FY00-01 to better understand the role of socioeconomics.

- The GCRMN *Socioeconomic Manual for Coral Reef Management*, edited by NOAA staff, was released in November 2000 (AIMS 2002, Fig. 116). Building on the manual, NOAA staff assisted in regional socioeconomic training workshops in East Africa and South Asia. With regional coastal environmental organizations, NOAA is planning additional workshops for the Caribbean and Southeast Asia.
- HCRI engaged Local, State, and Federal agencies as well as private organizations in its public awareness program on threats to coral reef ecosystems. They also implemented education and training programs for coral reef managers and scientists.
- NOAA is developing a web-based database of annotated references of existing literature on socioeconomic values of coral reef habitats.
- The FKNMS initiated a program in 1998 to monitor the economics of commercial fishermen displaced from fully protected zones (FKNMS 2002, Fig. 117). It also tracks trends in recreational tourism and its relationship to the local economy. Baseline estimates (1995-1996) were developed on 'protected area use' and a 5-year update was recently completed. Part of the report compares satisfaction of reef users and rates the many reef attributes.

Figure 116. Cover of the Socioeconomic Manual for Coral Reef Management.



Expand and Strengthen Marine Protected Areas (MPAs)

The USCRTF National Action Plan considers MPAs and areas with no-take provisions a key tool for protecting coral reef ecosystems and assuring

the sustainable use of reef resources. Used nationally and internationally, MPAs conserve biodiversity, protect endangered species, reduce user conflicts, and enhance commercial and recreational activities (Salm *et al.* 2000). Enforcement determines the effectiveness of this (or any) conservation measure.

Strengthen Current MPAs – Much has been done over the past few years by USCRTF agencies to strengthen MPAs, but most have been incremental and relatively unheralded. The following are examples of what some of the island governments have undertaken since 1999.

- The USVI Government initiated the development of a Marine Park Management Plan for a proposed marine protected area along the eastern end of St. Croix. Collaborating institutions are currently working on a socioeconomic assessment and resource description as well as a management plan for the USVI.
- Hawai'i has begun to inventory and assess its MPA system and is designing a new structure for designation and management. It is increasing the size of the Pupukea MPA on O'ahu and creating a no-take zone within this MPA.
- Guam is enforcing the waters within its five no-take coral reef reserves that protect about 20% of the island's shallow-water reefs (Fig. 118).

Expand No-take Protection – Although most jurisdictions have yet to achieve the 20% no-take protection goal for coral reefs (USCRTF 2000), areas protected by no-take reserves have significantly increased. Since 1999, Federal, State, Territorial, and Commonwealth agencies have taken unprecedented action in this area.

Florida – In 2001, NOAA, the NPS, the State of Florida, local communities, regional Fishery Management Councils, and other partners implemented the Tortugas Ecological Reserve, a 200 mi² (517.9 km²) fully protected marine reserve. With



Figure 117. Socioeconomic monitoring is studying the economic status of Florida Keys fishermen (Photo credit: NOAA).

other fully protected zones, the Tortugas Ecological Reserve increased the total protected area of coral reefs within the Sanctuary to 10%. It adjoins a 61 mi² (157.8 km²) Research Natural Area in the Dry Tortugas National Park. Together these areas protect near-shore to deep reef habitats of the Tortugas region and form the largest, permanent MPA in the United States.

Puerto Rico – In 1999, the Commonwealth established the Luis Peña Marine Reserve, its first no-take reserve. It is a 4.8 km² zone where fishing and anchoring are prohibited. In 2000, the 2.4 mi² (6.2 km²) Desecheo Marine Reserve was implemented, providing no-take protection for 4.2 mi² (11 km²) of coral reefs. Currently, 1.5% of the area covered by Puerto Rico's coral reefs is protected through no-take reserves.

USVI – In 2001, the Virgin Islands Coral Reef National Monument added about 20 mi² (51.43 km²) to the National Park off St. John. In 2001,

Buck Island Reef National Monument on St. Croix was expanded from about 1.4 mi² to 30 mi² (3.6 to 77 km²). The implementing language states “the Secretary [of the DoI] shall prohibit all extractive uses,” including fishing, with a few minor exceptions. This effectively makes it a no-take reserve that covers 17.4% of USVI coral reef ecosystems.

U.S. Remote Insular Reefs – In 1999, the Navassa Island National Wildlife Refuge was established by Administrative Order 3210 to

Figure 118. Tumon Bay Preserve is one of Guam's five no-take MPAs (Photo: Guam DAWR).



protect about 594 mi² (1,538 km²) of coral reefs and associated habitats (DoI 1999, Fig. 119). This Caribbean Refuge is open to artisanal fishing only.

In 2001, the islets of Palmyra Atoll were purchased from the Nature Conservancy by the DoI for inclusion in the Palmyra Atoll National Wildlife Refuge (Federal Register 2002a). This Refuge allows limited recreational fishing and wildlife observation activities. In 2001, the new National Wildlife Refuge at Kingman Reef was established (Federal Register 2002b). The entire refuge is protected by no-take provisions – a total of about 756 mi² (1,957 km²) of coral reef and other habitats are closed to access except for innocent passage through its waters.

Hawai'i – In 2000, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve was established by Executive Order (E.O. 13178). It is the largest U.S. marine protected area, covering approximately 130,900 mi² (339,900 km²) (NWHI Coral Reef Ecosystem Reserve 2002). About 21.4% of the Reserve is within the established Hawaiian Islands National Wildlife Refuge, and protected by no-take provisions.

CNMI – Currently, the CNMI has seven established MPAs. The Sasanhaya Fish Reserve in Rota is a no-take reserve. In 2001, three new MPAs on Saipan¹²³ were created but these have yet to be enacted into law. Overall, MPAs with no-take provisions protect about 3.7 mi² (9.6 km²), for a total of 1.7% of the shallow-water coral reef ecosystem.

Reduce Adverse Impacts of Fishing and Other Extractive Uses

Coral reefs and associated ecosystems support important recreational, commercial, and subsistence fisheries around the world. The rich reef biodiversity of reefs also supports a marine aquarium industry and represents genetic resources for future food, pharmaceuticals, and other products derived



Figure 119. Aerial view of northwest Navassa Island (Photo: Bob Halley and Don Hickey).

through mariculture or biotechnology. Unfortunately, these benefits are being undermined by overfishing and fishing-associated impacts to reefs.

Reef Fishing and Collecting for Aquaria – USCRTF

agencies took a number of important actions to reduce the impacts of fishing and aquarium collection on coral reefs in the different jurisdictions.

American Samoa – The Government developed a 5-year plan for coral reef management and banned the export of ‘live rock.’ The Governor issued an executive order prohibiting fishing with

SCUBA, addressing a major cause of overfishing of certain fishes. Three coastal villages joined the Department of Marine and Wildlife Resources’ community-based fishery management program. Two of these villages¹²⁴ created short-term replenishment areas where fishing is prohibited except during seasonal runs of big-eyed scad (*Selar crumenophthalmus*). Enforcement has also increased.

CNMI – The Commonwealth recently passed three laws that reduce fishing impacts. Commercial and non-commercial fishers are prohibited from using explosives, poisons, electric shocking devices, SCUBA, or hooks when harvesting reef fish or other marine life within the lagoon or reef, or within 1,000 ft of either.

Hawai'i – The State increased the minimum allowable size for all currently regulated reef fishes and invertebrates. It also prohibited harvesting aquarium fish along 355 miles of the West Hawai'i coastline.

To address concerns about the removal of Hawaiian reef fish for the aquarium trade, Hawai'i's DLNR funded the West Hawaiian Aquarium Project, at the University of Hawaii at Hilo and at other institutions (W. Walsh pers. comm.). Those results showed significant population declines in areas where fish had been collected. For example, at sites with regular collecting Achilles tang had been reduced by 63%, longnose butterfly fish by 54%, and yellow tang by 47% (Fig. 120), according to B. Tissot (pers. comm.) of Washington State

¹²³ Forbidden Island Sanctuary, Bird Island Sanctuary, and Mañagaha Marine Conservation Area.

University in Vancouver, B.C., who coordinated the project. This shows the type of applied research/monitoring needed to verify ecosystem condition, guide management decisions, and track changes after conservation measures are in place.

Puerto Rico – The Commonwealth is revising its fishing regulations regarding the capture and export of aquarium fish.

Florida – NOAA expanded its radar enforcement surveillance to include the new Tortugas Ecological Reserve.

Culture of Reef Species – NOAA's National Sea Grant program played a key role in bringing the scientific and commercial ornamental species industry together by sponsoring symposia and funding research on culturing reef ornamental species.

The two international symposia on marine ornamentals attracted nearly 500 scientists and industry representatives. Sea Grant Florida convened the Second International Symposium on Marine Ornamental Fishes in 2001 and published a major study on Florida's live marine ornamental industry (Larkin *et al.* 2001).

As an alternative to wild capture, NOAA's National Sea Grant Program has funded research programs in Puerto Rico, Florida, Texas, and Hawai'i on the culture of coral reef species. Over 20 species of fish, crustaceans, mollusks, and corals are now commercially grown.

The Marine Aquarium Council, formed through industry and regulatory agency cooperation, has developed a certification process for ornamental species. This certification will help assure the collection industry will be sustainable using safe and humane collection and transportation techniques, and optimum health and vitality for cultured ornamental species. Industry participants agreed to display the certification in their retail outlets.

Reduce Impacts of Coastal Uses

Rapid growth of both population and tourism in coastal areas poses increasing threats to the conservation of nearby coral reefs.

Coastal activities such as dredging for navigation or marinas, construction of shoreline protection structures, beach renourishment, sand mining, pipeline and cable installation, and destructive land-use practices¹²⁵ decrease water quality around reefs. Increased tourism has increased pressure on coral reef resources, either through direct impacts on the reefs or indirectly through increased levels of coastal development, sewage discharge, and vessel traffic. As the number of people using and transiting coral reefs increases, so does the frequency of vessel groundings on reefs.

A number of actions have been taken by the USCRTF to reduce these impacts.

Recreational Vessels and Water Sports –

Prohibitions on recreational vessels, especially jet skis, were implemented in sensitive areas in Puerto Rico using its revised Coastal Zone Management Program Federal Consistency Guidelines. Similarly, the CNMI imposed a moratorium on water sport operations until an impact assessment is completed. They also installed coral reef protection signs along the shorelines.

Reef Wildlife Feeding – In November 2001, after five public input-and-discussion sessions over two years, the Florida Fish and Wildlife Conservation Commission voted to ban feeding marine life by divers. Commissioners concluded any practice that modifies natural feeding habits is unacceptable, and practices that teach marine life to associate people with food are unhealthy for both.

Anchoring on Coral Reefs – Working through the International Hydrographic Organization, standard

Figure 120. Hawaiian reef species targeted by the aquarium trade, top to bottom, left to right: yellow tang, Moorish idol, gold ring surgeonfish, Achilles tang, and Potter's angelfish (Photos: Keoki Stender/Hawaii Coral Reef Network).



¹²⁴ Poloa and Alofa.

¹²⁵ Road construction, mangrove deforestation, and land reclamation for agricultural and urban development.



Figure 121 Divers installing a mooring buoy at Johnston Atoll (Photo: James Maragos).

symbols for 'No Anchoring Areas' for large vessels were added to its international catalog. The United States led an initiative to establish the first mandatory 'No Anchoring Area' in the FGBNMS. The International Maritime Organization granted NOAA its request in 2000 (FGBNMS 2002).

Permanent mooring buoys were installed at a number of national and international sites during 2000-2001. These delineate the site and allow boats to tie up for recreational diving and fishing without dropping anchor on the reef. NOAA's FGBNMS installed radar-reflecting buoys in the sanctuary and acquired mooring buoys, channel markers, and other aids to navigation with signs to mark protected areas.

Funded with Sportfish Restoration Funds, the Florida Department of Natural and Environmental Resources installed 200 mooring buoys near coral reefs. NOAA also funded the installation of permanent moorings in Hurricane Hole, USVI. The State of Hawai'i installed or replaced 26 mooring buoys at Molokini Shoal Marine Life Conservation District.

The U.S. Air Force and USFWS installed permanent moorings for recreational diving and snorkeling at the most popular dive sites around Johnston Atoll in the Indo-Pacific region (Fig. 121). Naval Station Guantanamo Bay purchased buoy markers to establish a boat-free zone at Phillips Park,

a popular dive site. The buoys were installed as a joint effort between Port Operations and the Base Dive club.

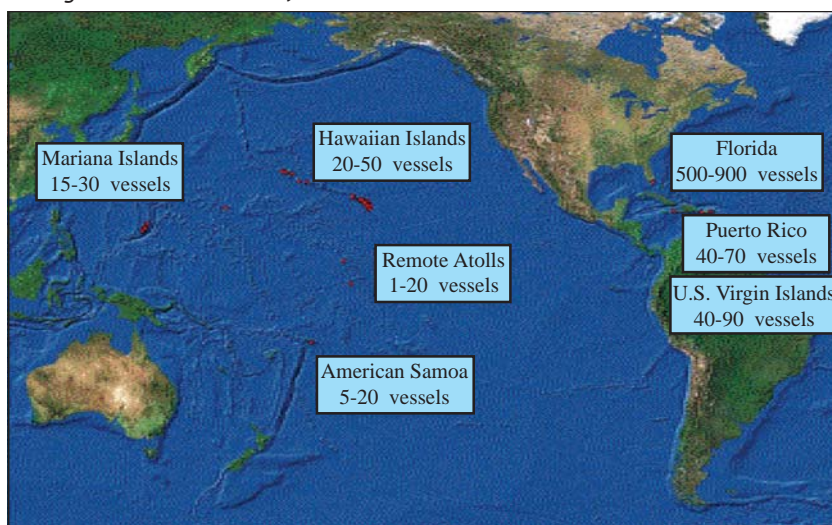
Grounded and Abandoned Vessels – A Racon-beacon system has been installed in the FKNMS to help prevent navigational errors and reduce future groundings and vessel-related injuries to coral and seagrass habitats throughout the Florida Keys.

NOAA created an abandoned vessel inventory GIS database (Fig. 122) and developed a draft abandoned vessel white paper evaluating legal authorities, prioritization of threats, and a response/removal plan for high risk vessels (NOAA/DAC 2002). Workshops were held in 2001 to provide technical assistance and develop national goals for managing impacts from grounded and abandoned vessels.

NOAA initiated the Restoration and Assessment of Coral Reef Ecosystems program to recover natural resource damages for injury to FKNMS sanctuary resources caused by vessel groundings. Legal settlements and restorations were obtained in several coral cases¹²⁶ (Fig. 123). Over 20 cases under the National Marine Sanctuary Act are currently in negotiation and litigation.

Beach Renourishment and Dredging – The USFWS, NOAA, and the Florida Department of Environmental Protection have relocated dredge materials from a Miami Beach nourishment project to an alternate borrow area and modified techniques to alleviate siltation and resultant coral

Figure 122. A draft map from the abandoned vessel inventory GIS (Photo: NOAA/ Damage Assessment Center).



¹²⁶ This includes the M/T Igloo Moon case in Biscayne NPS for \$1 million and a Puerto Rico Barge grounding for \$83.5 million.

damage. These agencies are preparing intensive monitoring and contingency plans for beach renourishment in Broward County. The plans will protect nearshore and offshore hardbottom and corals.

The U.S. Navy surveys and implements protective measures for coral reefs near the Pearl Harbor Entrance Channel as part of its annual dredging operations.

Federal Operations – The USFWS has begun examining past major Federal projects for impacts to coral reefs. The project is documenting types of mitigation proposed for the loss of coral resources and the effectiveness of the mitigation. One of the outcomes of this report will be a recommendation for other Federal and State agencies to improve mitigation tracking.

Since the *Coral Reef Protection Plan Implementation Plan* (DoD 2000) was issued, DoD has provided guidance to its forces to plan and budget for projects to sustain coral reefs. DoD has initiated an impressive number of new projects to reduce operations impacts on coral reef ecosystems.

The U.S. Army Corps of Engineers and USEPA instituted new prohibitions and restrictions on the use of some Clean Water Act Section 404 Nationwide permits for activities that affect ‘special aquatic sites’ (including coral reefs) and issued new guidelines to minimize impacts to coral reefs from Federally permitted projects.

The U.S. Navy developed *Coral Reef Protection Management Guidelines for DoD Vessels and Installations*. It includes best management practices for vessels operating in proximity to coral reefs and training protocols for personnel to implement such measures. DoD ports and associated reef ecosystems will be surveyed to identify priority areas based on significant use and/or sensitive reef conditions. This data will be used to develop further project requirements to protect coral reefs. Additionally, the Navy is developing a GIS-based information system to assist military personnel in



Figure 122. Removal of a grounded vessel in FKNMS (Photo: FKNMS).

identifying hazards and avoiding impacts to sensitive marine ecosystems.

Fort Kamehameha Outfall Extension, HI – In FY01, the Navy conducted a marine biological field survey of the entire project corridor to protect the limited coral resources within it. To avoid disturbing coral reefs, micro-tunneling to house the outfall pipe will pass below the fossil limestone bench on which the corals are growing.

Reduce Pollution

The USCRTF National Action Plan calls for Federal, State, Commonwealth, and Territory

agencies to better manage activities affecting coral reef resources, including habitat destruction and pollution. Managers of jurisdictions where human impacts are greatest have first responsibility for action. They have taken a number of significant conservation actions in FY00-01.

Water Quality – The USDA provided technical and financial assistance to landowners and operators to reduce agricultural non-point source pollution to near-shore coral reef ecosystems (Fig. 123). These contracts apply conservation measures to nearly 1,776 mi² of agricultural lands over the next 5-10 years.

The USEPA developed a strategy for creating coral reef indexes of biological integrity. USEPA

Figure 123. Runoff from agricultural lands (Photo: NOS Photo Gallery).



published *Nutrient Criteria Technical Guidance Manual for Estuarine and Coastal Marine Waters*, establishing scientifically defensible nutrient criteria for coastal and estuarine waters.

USGS, USEPA, USDA, the University of Hawai‘i, and the Hawai‘i Department of Health collaborated to address the impacts of sediments and nutrients on coral reef ecosystems by identifying research needs for better prediction of erosion and sediment management practices.

The USEPA and NOAA implemented the Water Quality Protection Program Action Plan for the FKNMS. It focuses on sea grasses and water quality, upgrading inadequate wastewater and stormwater infrastructure, and conducting public education and outreach activities to improve local stewardship.

Contaminant Biomonitoring – A biomonitoring program using reef fish to detect human impacts



Figure 125. Volunteers removing marine debris within the FKNMS (Photo: Paige Gill).

was developed for coral reefs off Johnston Atoll with collaborative funding by the U.S. Army Program Manager for Chemical Demilitarization, the U.S. Air Force Pacific Command, and the U.S. Coast Guard (EPA 2002). Reproductive and developmental parameters will be monitored in populations of blackspot sergeant major damselfish (*Abudefduf sordidus*) spawning in areas potentially impacted by chemical contamination. This will be compared with populations from non-impacted (control) areas. Samples of fertilized embryos are collected from the field and examined for developmental defects. The results are correlated with contamination.

Marine Debris – In 1996 and 1997, NOAA conducted the first surveys of derelict fishing gear in

the NWHI, a problem which has since been identified as the major human impact in these islands. From 1998-2001, NOAA led a multi-agency partnership¹²⁷ to remove marine debris from the NWHI.

Marine debris is also a concern in the Main Hawaiian Islands. In 1998, community groups, the military, and the Hawai‘i DLNR pulled more than 3.5 tons of nets and debris¹²⁸ out of Kane‘ohe Bay and Wai‘anae waters during three separate clean-up days (Clark and Gulko 1999). In 2000, Hawai‘i developed a database on marine debris ‘hot spots’ around the main Hawaiian Islands. NOAA also assisted in a large-scale reef cleanup on the shoreline around Kauai. Tesoro Oil Company sponsored the work as compensation for an oil spill from their offshore moorings off the east coast of Kauai.

On Saturday, September 15th, 2001, nearly one million people scoured 20,700 miles of beaches, oceans, and waterways all over the world as part of the 16th Annual International Coastal Cleanup. Volunteers collected more than 6,123,000 kg of trash – the world’s largest marine trash haul. The National Marine Debris Monitoring Program uses volunteer groups to monitor and remove marine debris from coastal beaches of the United States (Fig. 125). The data in the five-year program are compiled and analyzed by the Ocean Conservancy, and will be used by the USEPA to determine the effectiveness of current regulations against dumping at sea.

Invasive Species – An emerging issue, invasive species are generally believed to be a growing and imminent threat to marine resources (Carlton 2001). Carlton describes hundreds of species arriving daily in U.S. waters in ship ballast water, hull fouling, and by the deliberate or accidental release of species to the wild.

The Bishop Museum produced a *Guidebook of Introduced Marine Species in Hawai‘i* and hosted two workshops to explore the pathways of introduction and impacts of invasive species on coral reefs. They also supported research on phase shifts from coral reef to alien macroalgae. The USFWS funded and provided logistical support to the Bishop Museum for its *Marine Survey of Alien Species at Johnston Atoll National Wildlife Refuge and French Frigate Shoals in the Hawaiian Islands National Wildlife Refuge*. The report for

¹²⁷ This included the USCG, USFWS, U.S. Navy, the Hawai‘i DLNR, the University of Hawai‘i, the National Sea Grant College Program, the Hawai‘i Wildlife Society, and the Ocean Conservancy.

Johnston Atoll National Wildlife Refuge is now available.

The U.S. Navy requested Legacy Program project funding in 2002 to survey the microflora in ballast tanks on its vessels. Water from ballast tanks of ships will be surveyed to determine the live microflora transported as a function of Navy ship type and mission. The study will also develop procedures and validate methods for evaluating microbiological flora of bulk water stores for use by government and/or private laboratory facilities.

Restore Damaged Reefs

The USCRTF National Action Plan called for the restoration of coral reefs injured by vessel groundings and the development of new techniques and approaches for improving restoration. In response, Federal and State agencies have implemented a wide range of coral restoration projects using monies recovered from responsible parties through damage actions. Reef restoration requires a multi-disciplinary approach to be most successful (Precht 1998).

A 'Reef Medics' volunteer restoration program was established in the FKNMS (Fig. 126) and artificial reef training workshops were conducted in Florida and Puerto Rico. Two more workshops are planned for the Pacific.

Ship Removal and Reef Restoration – NOAA developed new methodologies to better assess damage from vessel groundings. NOAA, the Coast Guard, DoI, and island agencies updated the Environmental Sensitivity Index atlases for Puerto Rico, and the U.S. and British Virgin Islands. NOAA also held training sessions for partners in the Florida Keys and Hawai'i on the scientific aspects of oil spills in coral environments from

grounded ships. These activities will help managers respond more rapidly and effectively.

Florida – Large ships have been responsible for damaging or destroying an extensive tracts of coral reef habitat over the past ten years. However, recent reef restoration activities in the FKNMS have attempted to mitigate some of that damage.

These included emergency removal of rubble to prevent scouring by waves or storms and reattachment of severed branching corals.

To address the major cumulative effect of small-craft groundings, NOAA and the State of Florida have instituted a new initiative focused on developing and implementing rapid, high-quality ecological assessment techniques. With these, a large percentage of the 600+ annual groundings in the FKNMS will be assessed and the responsible parties prosecuted. The damages recovered will be used to restore the most severely injured areas.

For example, NOAA and the State of Florida reconstructed four spurs of an ancient coral reef in the FKNMS damaged by the grounding of a 47 m vessel. NCRI has begun a study of high-latitude reefs to evaluate variables concerning coral settlement and recruitment of coral fish assemblages on different restored habitats following a submarine grounding off the Southeast Florida coast.

Hawai'i – The Waikiki Aquarium and the Hawai'i DLNR are initiating a pilot project to restore damaged coral habitat in Kealakekua Bay on the island of Hawai'i. The Hawai'i DLNR, USFWS, and NOAA are working with the City and County of Honolulu to ameliorate the impacts of a marine wave break. This includes help from a local high school in transplanting and monitoring coral colonies.

American Samoa – The USCG, NOAA, DoE, DoI, and American Samoa cooperated to remove nine long-line fishing vessels grounded in Pago Pago

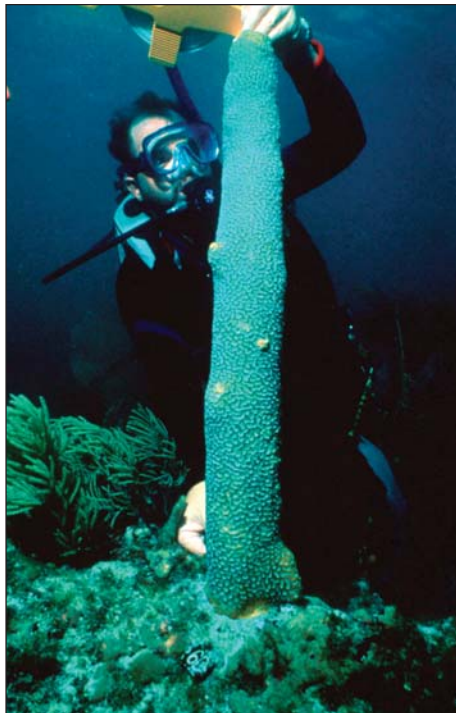


Figure 126. Transplantation of a pillar coral damaged in the FKNMS (Photo: Harold Hudson).

¹²⁸ Over 360 kg of broken stony corals were removed from these nets afterwards.

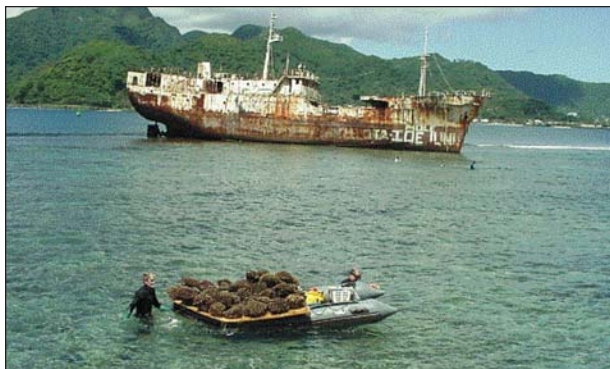


Figure 127. Relocation of corals prior to the removal of a ship wreck in Pago Pago Harbor, American Samoa (Photo: James Hoff).

Harbor during a 1991 cyclone. Prior to removal and to prevent further damage, NOAA temporarily relocated coral colonies away from the work area (Fig. 127). Once the vessels were removed, the relocated corals were returned and additional restoration activities begun. Survival of the restored reef habitat is being monitored.

Additionally, USFWS funded a reef restoration project to address the 1993 grounding and breakup of a 250 mT longline fishing vessel at Rose Atoll National Wildlife Refuge. Since 1993, the USFWS and the American Samoan Department of Marine and Wildlife Resources have periodically monitored the site (Green *et al.* 1998). The USFWS initiated a cleanup in 1999 and completed removal of shipwreck debris from the ocean reef flat and most debris from the slopes in 1999-2000 (Fig. 128). Over 100 mT has been removed, but about 40 mT remains in the lagoon.

Surveys in 2002 show cleanup actions have resulted in some reef recovery, but substantial impacts remain (J. Burgett and J. Maragos pers. comm.) There is a good chance additional funds from the USCG will be available for the USFWS to finish the cleanup in 2002-2003. Plans are being made to maintain a long-term monitoring program on this atoll through the next decade with the latest survey completed in February 2002 in cooperation with NOAA.

Coral Restoration on Artificial Surfaces – If successful, research using artificial surfaces for reef restoration could lead to new ways of repairing coral reef damage. NOAA and Dr. Chris Koenig deployed artificial structures with attached *Oculina* fragments in the Experimental Oculina Research Reserve. NOAA's FKNMS conducted two pilot

studies to reintroduce the long-spined sea urchin into patch- and fore-reef environments in the Florida Keys to reduce macroalgal biomass. Coral recruitment onto different structures used in FKNMS reef restoration projects was evaluated to identify optimal surfaces to enhance natural recruitment. Initial experiments in culturing spawned gametes of important reef-building coral species were conducted to improve settlement and recruitment potential.

A coral fragment holding and propagation facility was developed at the Florida Aquarium and two experimental coral nursery/restoration research projects were completed in the Florida Keys.

Seagrass and Mangrove Restoration – New mapping technology was employed and a spatial recovery model was developed for seagrass damage assessment work in the FKNMS. The USFWS is restoring mangrove habitats on the Culebra and Cabo Rojo National Wildlife Refuges (Fig. 129) and is assisting the Commonwealth of Puerto Rico in restoring reserves and coastal forests.

Over 1,000 acres of mangroves were restored through a DoD Legacy project in the Los Machos and Red Mangrove Forests to support the recovery and protection of nearby coral reefs.

Reduce Global Threats to Coral Reefs

The United States has interests in protecting international coral reefs. Healthy coral reef ecosystems are critical to U.S. diplomatic and development strategies to promote economic and food security, establish social stability, improve human health, and conserve global biodiversity. These extremely

Figure 128. Removal of metallic debris from the ship wreck at Rose Atoll (Photo: James Maragos).





Figure 129. A mangrove forest in Puerto Rico (Photo: John Christensen).

valuable ecosystems constitute the economic base and future hope for sustained development in many countries, particularly small island nations.

The USCRTF National Action Plan has diverse activities to protect and conserve reefs internationally, with an emphasis on capacity building and technical assistance. Accordingly, the USCRTF has developed strategies to reduce adverse impacts from global threats to coral reef ecosystems, including destructive fishing practices and international trade.

International Reef Conservation – The United States assisted 25 countries in the wider Caribbean, Central America, South East Asia, South Pacific, East Africa, and Middle East regions to improve their capacity for sustainable management and conservation. Additionally, management, education, and enforcement in 15 parks of national and international importance were improved. U.S. assistance was also given to the Ridge to Reef project in Jamaica, which integrates land-based management practices for agriculture, forestry, and urban planning with coastal activities, such as improving coastal water quality to protect the reefs. Development assistance was also awarded Mexico's first National Marine Park. It was initiated by a local community and recognized by the Mexican government in 2000.

In collaboration with the Western Hemisphere Convention Ramsar's Scientific and Technical Review Panel, the USFWS developed *Guidelines for the Ramsar Contracting Parties* to designate coral reefs, seagrass beds, and mangroves as Wetlands of International Importance. Guidelines were also developed for Western Hemisphere Coastal Zone Management. These guidelines have been

approved by the Convention's Standing Committee and will be presented to the Contracting Parties for adoption in 2003 by Ramsar. It is believed these guidelines will contribute to conservation at a global level. Brazil has already designated the Parque Estadual Marinho do Parcel Manoel Luis a Ramsar site. This park contains some 175 mi² of reefs.

NOAA strengthened the International Coral Reef Initiative and international recognition of the importance of coral reef conservation, and supported Global Coral Reef Monitoring Network initiatives (GCRMN 2002).

Reduce Impacts from International Trade in Coral Reef Resources

Food fish and live fish for the aquarium trade, construction materials, curios, jewelry, pharmaceuticals, and traditional medicines all come from coral reefs around the world. The USCRTF International Working Group assessed the U.S. role in the international trade and developed a comprehensive strategy to reduce adverse impacts. The State Department recommended Congress adopt new measures to ensure U.S. consumer demand does not contribute to the degradation of coral reefs.

Destructive Fishing Practices – The United States supported international programs under the East Asia and Pacific Environmental Initiative to address destructive fishing practices (Fig. 130) and other adverse aspects of international trade in coral

Figure 130. A diver extracts a lobster from a dynamite blasted reef in Indonesia. The diver's white squirt bottle probably contains cyanide, evidence of another destructive fishing technique (Photo: Mark Erdmann).



reef species. The State Department provided funds to developing countries to increase their human and institutional capacity, promote sustainable management practices, and enhance their ability to address local adverse impacts.

Trade in Marine Ornamental Species – USCRTF agencies provided financial and technical support to the Pacific Regional Workshop held in Fiji – Sustainable Management of the Marine Ornamental Trade. Additionally, U.S. sponsorship and organizational assistance was provided to the International Coral Trade Workshop; Development of Sustainable Management Guidelines, held in Jakarta, Indonesia.

The United States submitted an in-depth report on coral mariculture and a new standard identification manual for live Indo-Pacific corals used in international trade to the CITES Coral Working Group. Within the protocol, federal biologists volunteered to poll national authorities on the conservation status and levels of trade in black corals¹³⁰, review salient literature, and generate a report on the appropriateness of CITES protection. This report formed the foundation for discussions within CITES and eventual recommendations to retain CITES protection for black corals.

Landmark Legal Cases – The U.S. Justice Department awarded precedent-setting criminal convictions for illegally importing Caribbean spiny lobsters and protected corals. The first federal felony conviction involved a Florida company charged with smuggling and importing protected coral reef species from the Philippines¹³¹. In 2000, U.S. Federal and state law enforcement personnel successfully prosecuted three individuals for conspiring to illegally take 100 tons of coral and live rock from Hawaiian reefs for commercial sale¹³².

Create an Informed Public

The USCRTF strives to increase public understanding of coral reef conservation issues and engage the general public as well as local communities in conservation efforts. In FY00-01, USCRTF agencies expanded their education and outreach efforts, focusing on coral reef conservation and protection (Coral Reef 2002, Fig. 130). Most of these efforts are being done by State and Territorial agencies, although many have been assisted by Federal grants.

Coral Reef Conservation Fund – The Coral Reef Conservation Act of 2000 (CRCA) authorized NOAA to enter into an agreement with a nonprofit organization to establish and administer a Coral Reef Conservation Fund (the Fund). NOAA established the agreement with the National Fish and Wildlife Foundation (NFWF). Grants under the Fund support local-level public and private partnerships to conserve coral reefs. One of the major focus areas is increasing community awareness through education and stewardship activities. In 2001, the Fund provided approximately \$2 million in grants for education and public outreach projects.

Agency Outreach and Education Activities – State, Commonwealth, and Territorial agencies created brochures and other materials to educate the public on the *National Action Plan* and other coral reef activities.

The USFWS, the Florida Keys National Marine Sanctuary, and The Ocean Conservancy initiated an outreach program targeting resource users in the Florida Keys. They developed bilingual displays and printed materials on coral reefs for Puerto Rico and the USVI. The State of Hawai'i has produced a variety of outreach and education materials on

aspects of coral reef ecosystems, fishing laws and regulations, and basic natural history (Fig. 132). Guam instituted a unique village-to-village coral reef education 'road show.' CNMI completed a Coral Reef Education series on CD for distribution in the local school system.

Figure 131. From Florida to American Samoa, children learn about coral reefs through education and outreach programs (Photos: Nancy Daschbach and Heather Dine).



¹²⁹ Order Antipatharia.

¹³⁰ The company was fined \$25,000 and has five years probation. The owner will serve 18 months in prison, as well as pay a \$5,000 fine on top of other penalties.

The USDA provided 6,465 customers with conservation education assistance in developing sound conservation plans that collectively kept an estimated 397,773 tons of soil erosion from agricultural land from reaching Caribbean reefs. The USDA also helped to reduce pig waste contamination to reef ecosystems and helped American Samoan farmers upgrade their swine management skills.

NOAA distributed over 30,000 Coral Reef Teacher guides throughout Mexico and Belize.

Recently the Department of Defense prepared several outreach publications on coral reefs. The *DoD Coral Reef Protection Implementation Plan* provides guidance and information to the DoD services regarding protection of coral reefs, and DoD's relevant existing programs, policies, and current funding authorities (Defense Environmental Exchange Network 2002). The *Coral Reef Conservation Guide for the Military* is a general outreach brochure to heighten awareness within DoD (Defense Environmental Exchange Network 2002). It provides an overview of DoD activities that could potentially have adverse impacts on coral reef ecosystems and outlines pertinent DoD and U.S. national laws and policies regarding coral reef protection.

National Sea Grant Education – Through its network of state educators and extension personnel, Sea Grant has played a critical role in bringing coral reef issues and education to the public. One example of this work resulted in a cooperative program of Sea Grant, the USEPA, and the State Department producing an educational activity book for middle school students. This book is now being used around the world as a coral reef related educational program.

Sea Grant has presented numerous workshops and hosted town meetings in coastal areas on topics

such as MPAs, fisheries management, aquaculture, sea food, technology, coral reef mapping, the use of GIS for coastal management, and habitat preservation and management.

Non-Governmental Organization Contributions –

Non-governmental organizations (NGOs) have a significant role in addressing USCRTF education and outreach goals. A number of NGO groups performed a variety of coral reef education activities throughout the United States.

The project AWARE Foundation and Ocean Watch implemented their *Protect the Living Reef* campaign that teaches low-impact diving and snorkeling techniques. It incorporates videos and guides in a new certified Coral Reef Conservation specialty course from International PADI, Inc. and the Reef Condition Monitoring Program (Project AWARE 2002).

Through RECON and with support from the USEPA, the Ocean Conservancy and REEF

developed a rapid assessment protocol. It was field-tested by recreational divers and students. They surveyed the condition of stony corals, the presence of indicator organisms and conspicuous human-induced damage to reef systems in the wider Caribbean. Protocol training was provided to instructors and divers in the Florida Keys, US Virgin Islands, and Puerto Rico. The International Coral Reef Action Network¹³² designed a web-portal that provides the public general coral reef information, tools and resources, and a central coral reef communications and network hub (ICRAN 2002).

Improve Coordination and Accountability

The USCRTF was created to improve coordination and accountability among agencies and organizations responsible for the Nation's coral reef ecosystems. The Task Force, co-chaired by the Secretary of the Interior and the Secretary of Commerce,



Figure 132. Visitors to the Hawaiian Islands Humpback Whale National Marine Sanctuary learning about the wildlife that inhabits the area (Photo: Jeff Alexander).

¹³² A partnership of institutions and scientists interested in coral reef protection.

¹³¹ The settlement was a restitution payment of \$34,200 to the Hawai'i Department of Land and Natural Resources for reef restoration. There were also other personal fines and penalties.

includes the heads of 11 Federal agencies¹³³ and the Governors of seven States, Territories, and Commonwealths¹³⁴ with responsibilities for coral reefs (Fig. 133). Each governor appointed a Point of Contact to facilitate communication among members and tend to USCRTF business. The U.S. All-Islands Coral Reef Initiative¹³⁵ also has a representative on the USCRTF.

USCRTF agencies meet about every six months and exchange information at meetings held alternately in Washington



Figure 133. Cover of the USCRTF National Action Plan to Conserve Coral Reefs.

D.C. and at a different coral reef area so there can be public meetings on issues. At their request, the Presidents of the Republic of Palau, the Republic of the Marshall Islands, and the Federated States of Micronesia were invited to join the USCRTF in 2001. This structure has greatly increased partnership activities and integrated projects. The Task Force also has a mechanism for resolving problems among member agencies and grievances from the public.

¹³³ Department of Agriculture, Department of Commerce, Department of Defense, Department of the Interior, Department of Justice, Department of State, Department of Transportation, U.S. Environmental Protection Agency, National Aeronautics and Space Administration, National Science Foundation, U.S. Agency for International Development.

¹³⁴ American Samoa, Florida, Guam, Hawai'i, Northern Mariana Islands, Puerto Rico, U.S. Virgin Islands.

¹³⁵ Representing American Samoa, CNMI, Hawai'i, Guam, Puerto Rico, and the USVI.